Spring 5-1990

The Industrial Engineer's Role in the Quality Management Transformation

Michelle K. Lussier
University of Tennessee - Knoxville

The Industrial Engineer's Role

in the

Quality Management Transformation

Michele Lussier

April 1990

TABLE OF CONTENTS

Section I:

Introduction

The concept of quality management is sweeping the United States. Most of the major manufacturing companies have realized the importance of adopting some type of new management philosophy. They know that a transformation must occur or America will have difficulty regaining its competitive edge in the global market. Many companies have turned to Dr. W. Edwards Deming and his fourteen point strategy for guidance. They have also looked to their industrial engineers as a valuable resource for techniques that can be used to implement this new corporate philosophy. The following report will look at quality management (both what it is and what it involves), Dr. Deming's philosophy, the effects of quality management and then finally the role of the industrial engineer in this new style of management. From this, it will be determined if today's industrial engineering students at the University of Tennessee in Knoxville are being prepared to fulfill their role as they move into the world as professional engineers.

Section II:

Quality Management

Today, quality management has become one of the hottest trends in American companies, both manufacturing and service industries. In order to better understand this concept, it is necessary to understand the meaning of the terms "quality management".

First, quality management is not a technology. It is, in fact, a philosophy. A new way of thinking and a deep commitment are essential. An overnight transformation should not be expected. The road will be long and difficult, but the benefits will be countless.

With that, what exactly is quality management? Is it the management of quality or just good management techniques? Actually, both of these are correct. Quality management utilizes different engineering and management techniques such as statistical process control and quality circles to create a quality product, whether that product be tangible (i.e. a physical good) or intangible (i.e. a service). It is important "to manufacture products with the quality which can satisfy the requirements of consumers."[1] In other words, customer satisfaction should be a primary concern. If the customer is not satisfied with the quality of the product, the company will have difficulty selling that product regardless of its cost. The customer may even take his business elsewhere. This is where statistical process control (SPC) can be useful. By using control charts, companies can monitor their processes and produce quality products. Through statistical control, "the process has an identity; its performance is predictable."[2] Special causes of variation can be detected and eliminated. Once these variations are removed, products can be manufactured such that they meet the customer's

specifications. Also, maximum productivity is achieved and output is regulated. Less scrap is produced. In turn, customers are much more satisfied.

Another method widely used is quality circles or teams. This management technique is usually very popular with the employees. "Teamwork requires one to compensate with his strength someone else's weakness, for everyone to sharpen each other's wits with questions."[3] Employees assume more responsibility and take pride in their company. Furthermore, many companies have found that cross-functional teams are very beneficial because people in the various departments can present their unique opinions and concerns. Communication between the departments improves. This technique allows existing problems to be defined and solutions to be developed by the teams. Because of this, the effects the solutions have on the entire system are considered. The best, and most feasible, solutions are usually obtained. The employees have a sense of accomplishment and may even choose to celebrate their successes. The celebrations further enhance the spirit of teamwork.

The techniques discussed are only two examples. Many other techniques do exist, and some of these are discussed in Section V. Yet, it is evident that quality management is basically a common sense approach to managing. Even so, many companies have difficulty making this transition. Section III discusses one philosopher's strategy which will aid a company in determining what steps to take.

Section III:

The Deming Philosophy

One of the leading experts in the area of quality management is Dr. W. Edwards Deming. He has been the key to the success of the Japanese transformation. In the past 40 years, Japan has progressed from a nation with negative net worth to a world class competitor by following Deming's fourteen points. The Japanese are now known for top quality products. It has become difficult for other countries, especially America, to compete with them. According to Deming, "the basic cause of sickness in American industry and resulting unemployment is failure of top management to manage."[4] Managers must change their way of thinking. If changes are not made, America will not recover from its current situation. The following fourteen points are guidelines for making this transformation.

1. Create constancy of purpose for improvement of product and service.
2. Adopt the new philosophy.
3. Cease dependence on mass inspection.
4. End the practice of awarding business on the basis of price tag alone. Minimize total cost by working with a single supplier.
5. Improve constantly and forever the system of production and service.
6. Institute training.
7. Adopt and institute leadership.
8. Drive out fear.
9. Break down barriers between staff areas.
10. Eliminate slogans, exhortations, and targets for the work force.
11. Eliminate numerical quotas for the work force, and numerical goals for management.
12. Remove barriers that rob people of pride of workmanship.

13. Encourage education and self-improvement for everyone.
14. Take action to accomplish the transformation.[5]

The most important theme running through this strategy is the value of the work force. If everyone in the organization is treated with respect, then the organization will flourish. Managers should utilize employees to their fullest potential. By encouraging employees to make suggestions and to develop skills, the company goals can be obtained. Everyone will be working toward producing the highest quality product at the lowest cost. Furthermore, the work force will be more educated. The company can then be more progressive and try new things such as computer controlled equipment and processes, cellular manufacturing, and just in time manufacturing. They can advance with technology.

Besides the fourteen points, Deming also developed a strategy for making changes and evaluating them. This strategy is known as the Deming cycle. It involves a cycle of continual improvement. Deming stresses that a company should never be satisfied with their current systems and processes. Improvements can always be made. The Deming cycle has four main steps: plan, do, check, and act. It is graphically represented as shown in Figure 1. Obviously, the cycle is never-ending. By using this cyclical method, processes are evaluated, changed, and re-evaluated. That way, the effects of the changes are controlled. When used properly, the Deming cycle can improve quality and productivity, thereby transforming the company into a world class manufacturer.

By adopting Deming's strategies, the company can begin their journey to becoming a leader in their industry. Yet, what effects will adopting the new philosophy have on the company? What should the company expect? Section IV explores some of the most likely effects and expectations.

Systems Analysis Takes Place in PDCA Cycle - Engine of Continuous Improvement

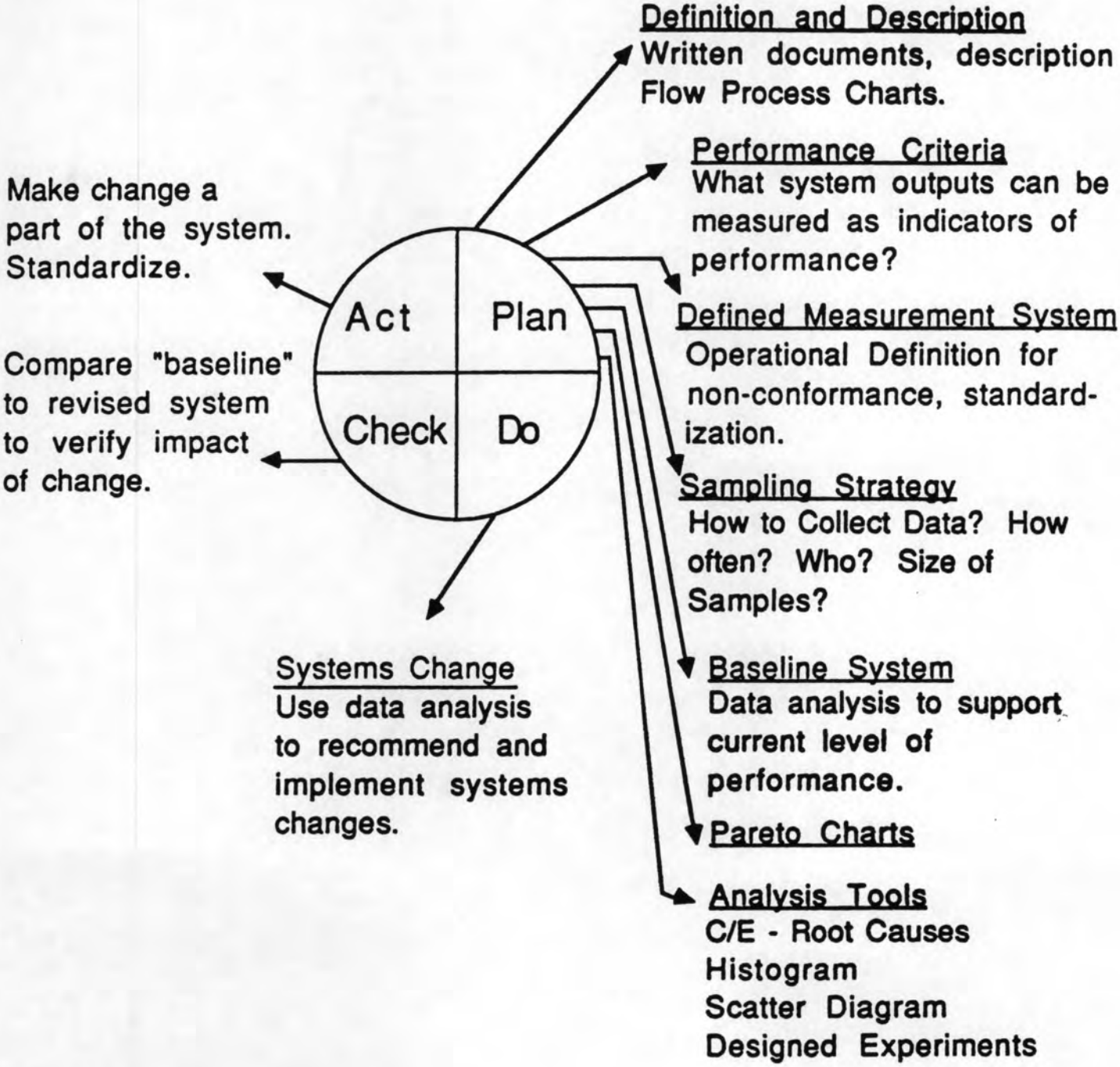

Figure 1: The Deming Cycle

Section IV:

The Effects of Quality Management

When a company adopts the quality management philosophy, several changes can be observed. These initial changes are the catalysts that start a chain reaction to transform the company into a world class competitor. Some changes may be very obvious while others may be minor, but all of them will benefit the company.

The first major change is the improvement in communication. Departments are no longer separated by barriers. Departments that have never communicated, but that rely heavily on one another, begin to see themselves in a customer-vendor relationship. They identify services and tasks they perform for one another. Once the customer relationship is in place, the departments work better together and try to help each other. They realize they are both working toward the same goal of bettering the company as a whole, and not in competition with each other. Communication improves and respect develops. Managers also begin to communicate more with their employees. They realize the valuable input they can gain from their employees. Many adopt an open-door policy so employees can voice their thoughts and concerns. Some may even establish a suggestion and award system so all ideas can be considered. Because of this, employees take pride in their work and help the company achieve its goals. They feel like their opinion counts, and that they contribute to the company's success. Overall, the entire company atmosphere improves.

Another major change is the company's improved competitive position. By continually improving the products and processes, the quality of the products increases. In turn, customer satisfaction increases. The company is then in a better position to attract new

customers, both locally and globally. Satisfied customers may even refer new customers to the company. Global competitiveness becomes a reality.

By improving product quality, less scrap is produced. This results in a major cost reduction. Employees are encouraged to do it right the first time. If this is done, then rework and scrap are eliminated. The elimination of these steps removes major non-value added steps. The production costs are reduced which then reduces the price of the finished product. The price becomes more competitive strengthening the company's position in the global market.

Probably the best way to sum the effects of quality management is to look at the improvement that results in productivity. Each of the changes previously mentioned ultimately affects productivity. For many years, the Japanese have known "that improvement of quality begets naturally and inevitably improvement of productivity."[6] When variation is reduced (which is a natural result of quality management, primarily SPC), productivity is improved. The company is then able to capture more of the market and to stay in business. The chain reaction of effects is summarized as follows:

Improve Quality → Costs decrease because of less rework, fewer mistakes, fewer delays, snags; better use of machine-time and materials → Productivity Improves → Capture the market with better quality and lower price → Stay in business → Provide jobs and more jobs[7]

As shown by the chain reaction, everyone benefits from quality management. Customers, blue collar workers and white collar workers are all satisfied. The customer receives the highest quality products at the lowest costs. The company stays in business and the workers keep their jobs. Everyone is satisfied.

Section V:

The Industrial Engineer's Role

The industrial engineer plays an important role in the quality management transformation. The course work of the industrial engineer teaches him several engineering techniques that are essential in implementing the quality management philosophy.

One such technique is statistical process control. As discussed in Section II, statistical process control is used to monitor and control processes so a quality product can be produced. In most cases, it is the industrial engineer who is responsible for developing, maintaining and interpreting the control charts. He must be able to identify special causes of variation in a process and remove them. It is his job to maintain control of a process.

Another technique required is just in time (JIT) manufacturing. This technique may also be used in conjunction with cellular manufacturing. Both of these reduce the amount of inventory a company has on site. The company only produces what is needed. The industrial engineer is usually responsible for implementing this new type of manufacturing system, also known as a pull system. The plant is commonly rearranged in such a way that equipment for a particular process is placed in a u-shape (Figure 2). Raw material goes in one end and finished product comes out the other end. The movement and queue times are dramatically reduced, as well as the in-process inventories. The company saves an enormous amount of money. Also in cellular manufacturing, workers are trained to be cross-functional. They are capable of running a variety of machines. Their skill level increases which makes them a greater asset to the company. They feel more important and take pride in their work. Because the industrial engineer understands the techniques of JIT

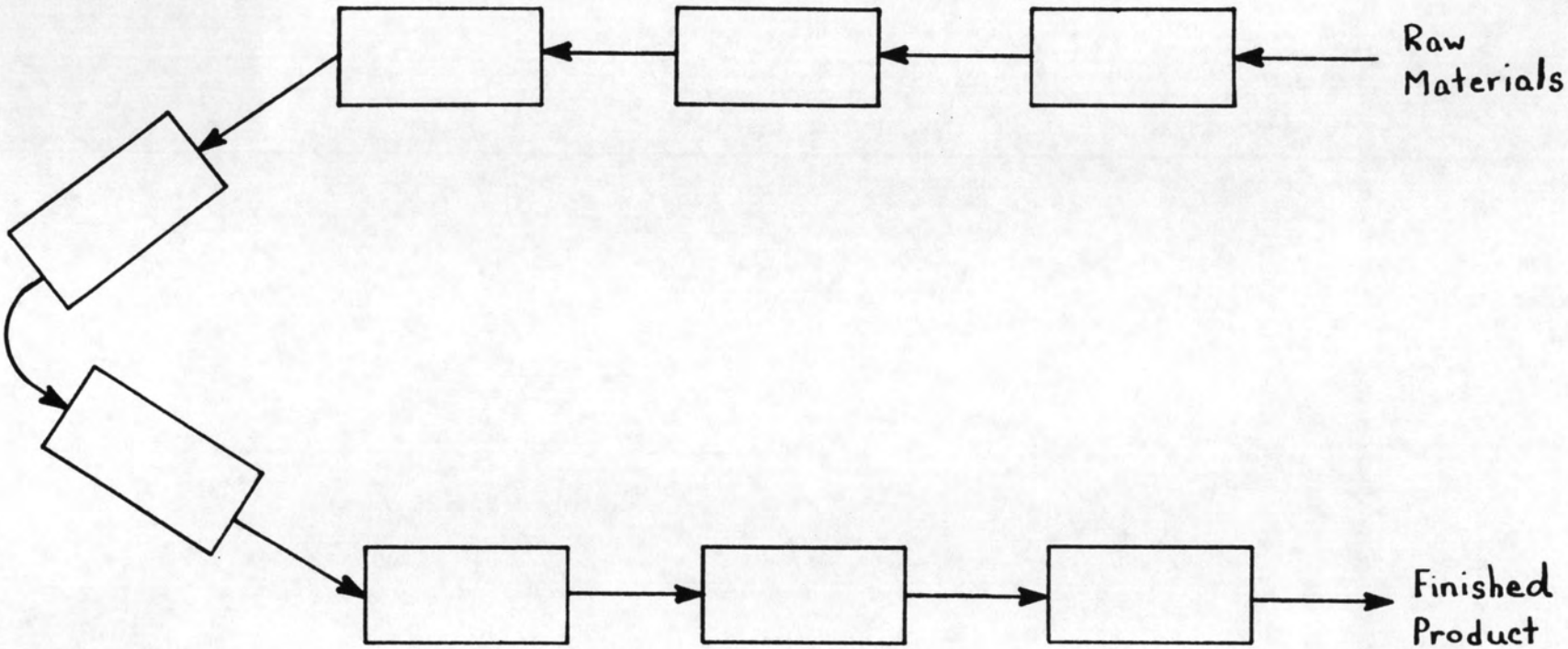

Figure 2: U-Shaped Cell Design

and cellular manufacturing, he is responsible for coordinating the conversion to the new system and providing training when appropriate. He may also be responsible for redesigning the layout of the plant since he is trained in layout design.

The industrial engineer's computer experience is another asset to the transformation process. The industrial engineer utilizes his simulation knowledge to predict the effects of JIT and cellular manufacturing on productivity. Bottlenecks are easily identified and corrected. The production flow is monitored and adjusted accordingly. Furthermore, the computer knowledge obtained in the industrial engineer's information systems course increases his awareness of the total system. For example, he is very conscious of the effects a change in the number of milling machines might have on the overall production flow in a particular job shop. He wants to utilize the machines' capacities to their fullest potential, but does not want to increase the work-in-process inventory; therefore, the relationships within the system are primary concerns.

Besides these techniques, the industrial engineer fulfills the role of the liason between management and hourly workers. The industrial engineer interacts heavily with both of these groups which makes him an ideal candidate to bridge the gap between them. He also has the "people skills" that are necessary for this type of situation. He should offer guidance to the managers on how to make the quality management transformation. He should also institute training for the workers so they can understand and can implement the new manufacturing techniques. The industrial engineer becomes a counselor and facilitator for both groups.

By comparing the industrial engineering curriculum at the University of Tennessee in Knoxville with the techniques mentioned above, it is evident that the industrial engineering students at UTK are being fairly well prepared to fulfill their future roles. The students do learn the concepts behind and the mechanics of these various techniques, but they are not given much instruction on how to actually implement them. Once they begin working for a company, they will be required to implement these techniques. Most of them will learn from their mistakes and from veteran employees. Yet, this should not be the case. Students should already have this knowledge when they graduate. They would be much better prepared if the procedures for implementation were taught along with the techniques.

Another improvement that needs to be made in the current curriculum involves an improvement in communication among the faculty. The students have difficulty understanding how the various techniques are related. Currently, only one course in the curriculum, the senior project course, attempts to tie the techniques together. Yet, this one course is not enough. Even as a senior who has taken the project course, I am still not sure where certain courses fit in (i.e. Operations Research, Manufacturing Materials and Processes, etc.). I feel the responsibility of integrating the course work should belong to the professors. They need to emphasize how the course they are teaching relates to the field of industrial engineering. They should also explain how the course relates to the new management philosophies that are sweeping America. Logically, this could best be accomplished by first improving the communication between the

professors. Each one needs to know what the others are teaching. This would eliminate any confusion or repetition that may occur. Consistent information regarding the techniques and philosophies is a necessity. Once the communication improves, then they could explain to the students how the techniques are related and how they can impact a company. Without this knowledge, the students will not be able to serve as effective liasons and facilitators. They must understand these relationships.

One other area that is lacking in the curriculum is the area of counseling, facilitating and training. Students do not take courses in group dynamics, assertiveness or presentations. Through my interviews this year, it has been apparent that companies feel these are very important topics that are not being taught effectively in the classroom. Most companies offer their own, in-house training courses in these areas. They also offer courses that study the quality management philosophies more in depth. Companies should not have to provide this training. Students should have a better understanding of the philosophies and group dynamics when they graduate, as well as be assertive and able to make effective presentations. That way, they would be better liasons for the managers and the hourly workers.

It is evident that just understanding engineering techniques is no longer enough. Industrial engineers must learn the management techniques taught by the quality management philosophies, as well as the implementation procedures for the various engineering techniques. The voids in the college curriculum need to be eliminated. If the department improves in these areas, then the UTK

industrial engineering students will be even better prepared to fulfill their roles. They will be under high demand when they graduate. Companies will know that their new recruits from UTK do not require the same type of special training as recruits from other universities.

Section VI:

Conclusion

From the previous discussion, it is evident that the University of Tennessee in Knoxville is doing a fair job of preparing the industrial engineering students for their future careers. However, some changes do need to be made. These changes will further enhance the curriculum, and will, in turn, better educate the students so they can be valuable resources to a company. As discussed in this report, it is evident that companies desire industrial engineers who understand the quality management philosophies. These philosophies, such as Deming's fourteen points, are here to stay. The adoption of these philosophies by companies will be the deciding factor in determining who will be globally competitive. Without a good philosophy, a company will slowly die in this competitive world. American companies must meet this challenge and participate in the quality management transformation.

NOTES

[1]Kaoru Ishikawa, What is Total Quality Control? The Japanese Way (Englewood Cliffs, N.J.: Prentice-Hall, 1985), p. 44.

[2]W. Edwards Deming, Out of the Crisis (Cambridge, Mass.: MIT, Center for Advanced Engineering Study, 1986), p. 340.

[3]Deming, p. 64.

[4]Deming, p. ix.

[5]Deming, pp. 24-86 (only the boldfaced statements of Deming's fourteen points).

[6]Deming, p. 2.

[7]Deming, p. 3.

BIBLIOGRAPHY

Badiru, Adedeji B. "A Systems Approach To Total Quality Management." Industrial Engineering Mar. 1990: 33-34, 36.

Deming, W. Edwards. Out of the Crisis. Cambridge, Mass.: MIT, Center for Advanced Engineering Study, 1986.

Desatnick, Robert L. "Long Live the King." Quality Progress Apr. 1989: 24-26.

Goldratt, Eliyahu M. and Jeff Cox. The Goal: A Process of Ongoing Improvement. New York: North River Press, 1986.

Ishikawa, Kaoru. What is Total Quality Control? The Japanese Way. Englewood Cliffs, N.J.: Prentice-Hall, 1985.

Pfau, Loren D. "Total Quality Management Gives Companies A Way To Enhance Position In Global Marketplace." Industrial Engineering Apr. 1989: 17-18, 20-21.

Rohan, Thomas M. "The Magic of SPC." Industry Week 5 June 1989: 60-63.